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ELECTRICAL DEVICE

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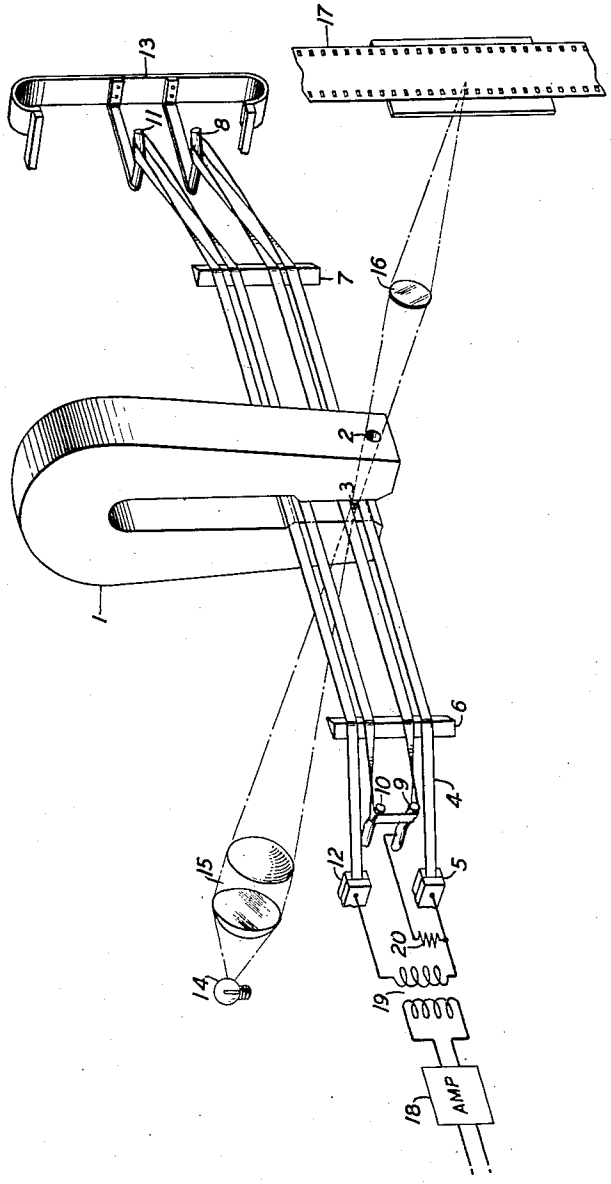

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ELECTRICAL DEVICE

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5 Claims. (Cl. 88—61)

This invention relates to electric devices and particularly to devices having elements mounted so as to have a natural frequency of vibration.

The object of the invention is to compensate for the inherent variation in sensitivity of these devices due to their natural frequency of vibration.

A feature of the invention is an element having the same natural frequency of vibration as the moving elements of the device connected so that the inherent increase in impedance of this element will counteract the increase in sensitivity of the moving elements.

Another feature of the invention is an impedance element connected in shunt with the supply circuit which causes the moving elements to move.

In many known electric meters and devices for controlling light, such as oscillograph, light valves, etc., the moving elements are mounted to form a mechanical vibrating system having mass, elasticity and stiffness. Such a mechanical system will have one or more natural frequencies of vibration, determined by the mechanical constants of the system. For frequencies approaching the resonant frequency of the system, the sensitivity or amplitude of response for given power increases rapidly and, at the same time, the motional impedance of the device also increases rapidly.

The invention may conveniently be described as applied to a light valve for film sound recording.

The recording elements of the light valve may be vibrated by electric currents flowing in the element itself, as in U. S. Patent 1,852,774, April 5, 1932 to E. W. Gent and L. M. Potts and U. S. Patent 1,914,186, June 13, 1933 to E. C. Wente, or by currents flowing in a moving coil attached to the element as in U. S. Patent 1,836,558, December 15, 1931 to R. J. Sherman; or by currents flowing in a fixed coil influencing the elements as in U. S. Patent 1,794,513, March 3, 1931 to O. O. Ceccarini. For convenience of description, only the first type of light valve will be illustrated although it will be apparent to those skilled in the art that the invention is not limited to the specific type of light valve illustrated but is equally applicable to the other types mentioned and to oscillographs and many electric meters.

In accordance with the invention, a dummy light valve, mechanically similar to the recording light valve, is placed in series with the recording light valve in the electrical circuit supplying power to the recording light valve. The dummy light valve does not, in any way, affect the recording light beam. When the frequency of the currents to be recorded increases, the motional impedance and the electrical impedance of the dummy light valve increase. As the dummy light valve is in series with the recording light valve, the increase in the electrical impedance of the dummy light valve will decrease the current actuating the recording elements and thus compensate for the increased sensitivity of the recording elements.

To further aid in controlling the sensitivity, a fixed impedance may be connected in parallel relation with the portion of circuit actuating the recording elements. When the frequency of the currents increases, the electrical impedance of the recording light valve also increases and an increasing amount of the signal currents will flow through the fixed impedance, thus variably decreasing the currents actuating the light valve.

The drawing diagrammatically shows an embodiment of the invention.

The light valve has a magnet 1 having parallel pole faces pierced by aligned apertures 2, 3. The magnet 1 may be a permanent magnet or an electromagnet and the pole faces may be formed as part of the magnet or may be a separate element formed of magnetic material. A flexible conducting ribbon 4 is stretched from the support 5 over the insulating bridges 6 and 7 around the insulating support 8 back over the bridges 6 and 7 to the support 9. The two portions of the ribbon 4 are so disposed as to define a light transmitting slot aligned with the apertures 2, 3 in the magnet 1. A similar ribbon is also stretched from the support 10 over the bridges 6, 7 to the support 11, thence back over the bridges 6, 7 to the support 12. The ribbon stretched from support 10 to support 12 may be a portion of the ribbon 4, as shown, or may be a separate ribbon having similar mechanical properties. When both ribbons are of the same length and dimensions, both ribbons may be tensioned by a single spring 13 attached to the movable supports 8, 11. If separate ribbons are used they may be tensioned by separate springs attached respectively to the supports 8 and 11.

The specific details of construction of the light valve are not important and may be varied without departing from the invention. The light valve may, for example, be constructed similarly to the light valve shown in U. S. Patent 1,852,774, April 5, 1932 to E. W. Gent and L. M. Potts. Light valves of similar type are described in detail in an article "The Principles of the Light

Valve" by T. E. Shea, W. Herriott and W. R. Goehner, published in the Journal of the Society of Motion Picture Engineers, vol. XVIII, pp. 697–730, June, 1932.

The active light valve and the dummy light valve will normally be tuned to the same frequency of mechanical resonance. A small error in tuning will not render the valve inoperative but will merely reduce the effectiveness of the compensation.

Light from the source 14 is focussed by the lens system 15 to illuminate the slit defined by the ribbon 4 in the aperture 2. This illuminated slit is imaged by the lens 16 on the constantly moving photographic film 17.

Signal currents from any suitable source, such as a microphone, pick-up, etc., are amplified in the amplifier 18 and induce an electromotive force in the secondary winding of the transformer 19. Current flows from transformer 19 to support 5, through the four sections of the ribbon 4 to support 12, thence back to transformer 19. The current flowing in the ribbon between supports 5 and 9 causes the sections of the ribbon to oscillate, thus varying the exposure of the film 17 in accordance with the signal currents.

An impedance 20 may also be connected from support 5 to support 9 in parallel relation with the active light valve ribbon. This impedance may be of the same order as the impedance of the active ribbon at low frequencies. The impedance 20 may be non-inductive or may have an inductive component resonating with the capacity of the light valve at some frequency less than resonance.

In a mechanically tuned light valve, the impedance of the moving elements increases very rapidly as the frequency of the applied current approaches the frequency of mechanical resonance. Also, the sensitivity increases, that is, the current required to produce any given deflection decreases rapidly when approaching the frequency of mechanical resonance. In the present invention, when approaching the resonant frequency, the electrical impedance of the ribbon between supports 10 and 12 increases rapidly thus reducing the current flowing in the ribbon between supports 5 and 9 and the amplitude of oscillation which would be produced.

At low frequencies, the signal current will be divided between the impedance 20 and the ribbon stretched between the supports 5 and 9. For convenience, the current may be considered as equally divided, although other proportions may obviously be used. Now, when the frequency of the signal current approaches the frequency of mechanical resonance of the ribbon 4, the electrical impedance of the ribbon 4 will increase rapidly. As the impedance 20 does not change, a smaller proportion of the current will flow through the ribbon 4 and the amplitude of oscillation will be lessened.

Thus, the portion of the ribbon between the supports 10 and 12, and the impedance 20, cooperate to cause a reduction in the current flowing in the ribbon between the supports 5 and 9, which reduction increases rapidly when approaching the resonant frequency. The sensitivity of the light valve is thus made more nearly uniform throughout an extended range.

What is claimed is:

1. In a light valve, in combination a magnetic structure having aligned apertures, an electrical conductor arranged to form a light transmitting slit controlling the transmission of a beam of light passing through said apertures, a second electrical conductor arranged out of alignment with said apertures and ineffective to control the transmission of said light, means for supporting both said conductors in the magnetic field of said structure, means for tensioning both said conductors to have substantially the same frequency of mechanical resonance, and means for supplying signal currents to both said conductors in serial relationship to cause both said conductors to vibrate substantially in accordance with the signal currents whereby the effects of mechanical resonance on the control of said light beam are substantially reduced.

2. The combination in claim 1 with an electrical conductor of low impedance connected in parallel relationship with the ends of the conductor controlling the light.

3. In a light valve, in combination a magnetic structure having aligned apertures, a looped conducting ribbon defining a light transmitting slit aligned with said apertures, a similar looped conducting ribbon arranged to be out of alignment with said apertures, means for supporting both said ribbons in the magnetic field of said structure under tension so as to have substantially the same frequency of mechanical resonance, and means for supplying signal currents to both said ribbons in serial relationship to cause both said ribbons to vibrate, the first ribbon varying the light transmitting slit in accordance with the signal currents, the second ribbon presenting a variable impedance whereby the effects of mechanical resonance on the motion of the first ribbon are substantially reduced.

4. The combination in claim 3 in which the sides of said loops are parallel.

5. The combination in claim 3 with an electrical impedance connected in parallel relationship with the ends of the ribbon defining the slit.

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